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March 21, 1995

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

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MAR 21 1995

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

RE: Erratum to Ex Parte
CC Docket Nos. 79-252, 93-197/80-286

Dear Mr. Caton:

DOCKET FILE COPY ORIGINAL

This letter is an erratum to an ex parte filed by AT&T on March 16, 1995. Several pages were inadvertently omitted from the attachment titled, "Is the Dominant Firm Dominant? An Empirical Analysis of AT&T's Market Power." Attached is a copy of the complete document for the record. We apologize for any inconvenience this may have caused.

Sincerely,

A handwritten signature in dark ink, appearing to read "E. E. Estey", with a stylized flourish at the end.

Attachment

cc: Ms. Anna Gomez
Mr. Michael Katz
Ms. Kathleen Levitz
Mr. Richard Metzger
Mr. John Morabito
Mr. John Muleta
Mr. Donald Stockdale
Mr. Mark Uretsky
Ms. Kathleen Wallman

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**FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY**

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

RE: Ex Parte Presentation
CC Docket Nos. 79-252, 93-197, 80-286

Dear Mr. Caton:

On Wednesday March 15, Neil Briskman, David Kasserman, Al Lewis, John Mayo, Gerard Salemme and I met with Anna Gomez, Michael Katz, Kathleen Levitz, Richard Metzger, John Morabito, John Muleta, Donald Stockdale, Mark Uretsky and Kathleen Wallman to discuss the above-captioned dockets and the attached materials.

Because the meeting was held late in the day, two copies of this Notice are being submitted on the following business day to the Secretary of the FCC in accordance with Section 1.1206(a)(1) of the Commission's rules.

Sincerely,

Attachments

cc: Ms. Anna Gomez
Mr. Michael Katz
Ms. Kathleen Levitz
Mr. Richard Metzger
Mr. John Morabito
✓ Mr. John Muleta
Mr. Donald Stockdale
Mr. Mark Uretsky
Ms. Kathleen Wallman

**IS THE "DOMINANT FIRM" DOMINANT? AN EMPIRICAL ANALYSIS OF
AT&T'S MARKET POWER**

by

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Auburn University

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January 1995

The authors would like to thank John Jackson for his assistance in the conceptualization and specification of the econometric model.

IS THE "DOMINANT FIRM" DOMINANT? AN EMPIRICAL ANALYSIS OF AT&T'S MARKET POWER

I. Introduction

Between 1934 and 1969, virtually all long distance service in the United States was provided by the American Telephone & Telegraph Company (AT&T). Commensurate with that monopoly supply, the Federal Communications Commission (FCC) and state utility commissions regulated virtually every aspect of the company's economic decisions, including pricing, investment, quality, and markets served. Beginning in 1969, however, AT&T started to feel the pressure of competitive entry. In that year, MCI began offering private line service to business customers in limited but direct competition with AT&T. This firm proved to be the first of what was eventually to be many competitors in the long distance industry.¹

In response to this emerging competition, the FCC adopted a new form of regulation in 1980. At that time, the agency created a regulatory taxonomy for interexchange telecommunications companies wherein firms are classified as either "dominant" or "nondominant."² As originally described by the Commission, the rationale for this classification scheme was to remove unwarranted regulation from carriers that did not possess sufficient market power to "sustain prices either unreasonably above or below costs" (the

¹ According to FCC figures, there are now over 400 long distance carriers in the U.S. For a complete historical account of the evolution of the pre-divestiture industry, see Temin (1987) or Faulhaber (1987). For a discussion of post-divestiture developments in the long distance industry, see Kaserman and Mayo (1994).

² Subsequent to the FCC's enactment of the Dominant/Nondominant framework, several states, including California, Texas, and Massachusetts, followed suit for the regulation of intrastate long distance services.

"nondominant" firms) , while retaining more stringent regulatory controls over firms that had "substantial opportunity and incentive to subsidize the rates for more competitive services with revenues obtained from its monopoly or near-monopoly services." (the "dominant" firms).³ Clearly, then, the classification decision was to hinge on the degree of market power held by the various firms under the FCC's jurisdiction.

This classification of interexchange companies into dominant or nondominant categories has had substantive implications for the degree of regulatory control of the firms in this industry. Specifically, for firms found to be nondominant, the FCC has relinquished virtually all direct regulatory control over pricing and investment decisions.⁴ In contrast, where a firm is classified as dominant, the extent of regulatory control is considerably greater. Indeed, for the sole interexchange company classified as dominant--AT&T--complete rate-of-return regulation was imposed until 1989. Although a price-cap regulatory scheme was enacted for AT&T in that year, this firm continues to be uniquely classified as the sole "dominant" carrier in the interchange marketplace. And, on the basis of that classification, there continues to be a substantial asymmetry between the regulatory controls applied to AT&T and its competitors.⁵

³ Federal Communications Commission, First Report and Order, CC Docket No. 79-252, p.6. Elsewhere in the same Report and Order, the Commission indicated that carriers would be classified "as dominant or non-dominant depending upon their power to control prices" (p.10).

⁴ Indeed, the FCC went so far as to abandon the requirement that nondominant firms file tariffs with the Commission. This decision was, however, recently found by the Supreme Court to violate the Federal Communications Act of 1934, which requires the filing of such tariffs for all telecommunications companies providing interstate services.

⁵ This asymmetric regulation has been severely criticized. See Kaserman and Mayo (1988). Others, e.g., Shepherd (1993) have defended the perpetuation of the current framework.

Although federal regulatory authorities have increasingly acknowledged the myriad benefits of deregulation in a competitive environment, they have yet to move to a price-deregulated long distance industry by removing the classification of AT&T as "dominant."⁶ This unwillingness to end direct economic regulation of AT&T is apparently due to concerns that AT&T might retain a significant amount of residual market power. Given the relatively large market share still held by AT&T, such doubts are primarily attributable to uncertainty concerning the strength of the disciplinary force of fringe firms' production in this market.⁷ In this environment of uncertainty, it has been argued, inter alia, that premature deregulation could lead either to unwarranted price increases that damage consumer welfare and threaten universal service or to predatory price decreases that could retard or terminate the emergence of effective competition in this industry.

The appropriate policy toward AT&T, of course, fundamentally depends on the issue of the degree of its monopoly power. This issue has been the subject of extensive debate in regulatory hearing rooms throughout the country, before state and federal legislative bodies, and in the economics literature. Divergent opinions concerning this question have influenced

⁶ An FCC docket (No.79-252) is currently open to take evidence on whether AT&T should remain classified as "dominant." Also, note that we use the term "price-deregulated" here to refer to the ending of the policy of asymmetric regulation and the concurrent ending of price regulation of AT&T. This, of course, does not mean that the industry would be completely deregulated as regulatory oversight functions of the FCC (including the filing of tariffs) would almost certainly continue.

⁷ Uncertainty concerning the ability of fringe producers to enforce competitive pricing in this industry arises under two alternative scenarios. First, entry and expansion barriers might impede the ability of these firms to respond effectively to price increases. And second, tacit collusion might make them unwilling to respond even if they have the ability to do so. Because successful tacit collusion generally requires the presence of entry barriers, however, these two areas of concern ultimately spring from the same source.

regulatory decisions and legislative proposals ranging from relaxed regulation of this firm to removal of the MFJ restriction on entry by the Bell Operating Companies (BOCs) into the interLATA market. No other question is likely to have as profound an effect on our public policy toward this industry in the coming years.

To date, however, virtually all evaluations of AT&T's market power have been based upon a more-or-less traditional antitrust analysis of the market structure within which this firm operates.⁸ That is, these evaluations have relied upon evidence pertaining to such structural characteristics as market share and barriers to entry to reach judgmentally-based conclusions about the degree of control over price that AT&T is likely to possess in a deregulated environment. To a large degree, the substantial differences of opinion that have emerged may be traced to different implicit weights that the individual economists and regulatory agencies have attached to these various structural attributes (e.g., market share versus entry conditions) and divergent expectations with respect to the likelihood of concerted action on the part of firms in this industry.

A more modern empirically-based approach to the evaluation of market power, however, has emerged in the economics literature over the past decade.⁹ Several alternative econometric techniques have been introduced to estimate the extent to which individual firms' output decisions influence market price. Implementing one or more of these techniques can, under certain conditions, yield an estimate of the price elasticity of the individual firm's

⁸ See, e.g., Kaserman and Mayo (1988); Shepherd (1993); Porter (1993); Hall (1993); and Kaserman and Mayo (1994). In a different vein, Ward (1993) provides an econometric approach.

⁹ See, e.g., the papers included in the issue-length conference on "Empirical Approaches to Market Power," Journal of Law and Economics Volume 32 (October 1989).

residual demand curve. The inverse of this elasticity, then, provides a direct estimate of the Lerner index of the degree of monopoly power held by that firm.

In this paper, we estimate the residual demand elasticity and associated Lerner index for AT&T in the interstate long distance market in the post-divestiture period. Because of the continued presence of regulation and other considerations, however, a straightforward estimation of this elasticity along the lines outlined in Bresnahan (1989) is not feasible. Instead, we are forced to take a more indirect approach that utilizes estimates of the underlying components of the desired elasticity. This approach makes use of the dominant firm/competitive fringe (DF/CF) model to impose the structure needed both to obtain estimates of the relevant structural parameters and to translate these parameters into an estimate of AT&T's residual demand elasticity and Lerner index.

The resulting estimates strongly support the conclusion that AT&T lacks significant market power in the post-divestiture long distance market.¹⁰ In addition, the empirical results also fail to support the hypothesis that tacit collusion has emerged in this industry in recent years. While such evidence is not likely to completely resolve the ongoing debate about the appropriate regulatory policy for this industry, it should contribute to the overall quality of that debate by adding an alternative approach that is well founded in modern econometric methods of estimating market power.

¹⁰The "significant," modifier is used here because outside the textbook world of perfectly competitive markets, all firms, in reality, have some market power. Thus, policy decisions should turn not on the existence but degree of monopoly power. In this regard, it is generally acknowledged that for policy purposes it should be the presence of significant amounts of monopoly power that give rise to bona fide concerns regarding market failure. See, e.g., Kaserman and Mayo (1995) and Areeda and Kaplow (1988).

The paper is organized as follows. First, given the potential for confusion stemming from alternative meanings of the term "dominant," Section II provides a clarification of the alternative uses to which this term has been put. Next, in Section III, we describe various conceptual considerations related to formulation of the empirical model. In Section IV, we provide a description of the data and present our estimation results. The residual demand elasticity estimates and market power calculations are then reported and interpreted in Section V. Section VI presents our empirical results concerning the tacit collusion issue. Finally, we conclude the paper with Section VII.

II. Alternative Meanings of the Word "Dominant"

Debates on any topic are ill served by the use of imprecise language, and debates about technical issues such as market power are particularly difficult to resolve when participants implicitly employ different definitions of a common term. This problem of divergent definitions has plagued discussions involving use of the word "dominant" both in the economics literature and public policy forums for many years. Moreover, because the term "dominant" has become a cornerstone of telecommunications policy over the past decade, it is important to establish a clear definition of this word at the outset.

Although the term is generally understood to apply to a firm that is large relative to the other firms in the market, there is a distinct difference of opinion about what this comparative size implies about the degree of control the firm labeled as dominant is able to exercise over market price. Specifically, two groups of analysts have attached very different meanings to this word. One group equates the phrase "dominant firm" to a producer that

holds significant market power.¹¹ Under this definition, dominance requires the combination of both a large market share and substantial barriers to entry and expansion. Otherwise, either actual or potential competition will deny the firm the unilateral control over market price necessary to warrant such a classification. This use of the word appears to correspond to the meaning intended by the FCC and various state laws directing public service commissions to classify long distance carriers as either dominant or nondominant for regulatory purposes.¹²

A second group of analysts employs a more limited definition of this term that is directly tied to the DF/CF market model. To this group, a "dominant firm" is a relatively large firm that inhabits an industry containing many smaller firms, each of which takes price as given (i.e., each views the market price as being unaffected by its own output decisions). It is this composition of the remainder of the industry (the so-called fringe) that differentiates a dominant firm industry from an oligopolistic industry. In the former case, recognized mutual interdependence is unidirectional (and is, therefore, neither mutual nor interdependent).

¹¹ This usage appears to be fairly widespread in the economics literature. See, for example, Bjorndal, et al. (1993) and Stigler (1965).

¹² See Federal Communications Commission, First Report and Order, CC Docket 79-252. State regulatory bodies have adopted a similar connotation to the term 'dominant.' For example, the Texas Public Utility Regulatory Act of 1985 defines the term as follows:

"'dominant carriers' when used in this Act means ... a provider of any particular communication service ... who as to such service has sufficient market power ... to enable such provider to control prices in a manner adverse to the public interest ..." (p. 2)

See also, the interpretation of the California Public Utility Commission which stated that a firm is dominant if it "has the market power either to extract monopoly profits or to price predatorily, while the non-dominant carrier has the power to do neither" D.84-06-113, p. 82.

The dominant firm takes the anticipated reaction of the fringe into account in making its pricing decisions, but the fringe fails to incorporate the dominant firm's reactions in their own output choices. In a purely oligopolistic industry, however, there are comparatively few industry participants (each holding a relatively large market share). Under such circumstances, true mutual interdependence is likely to be present. Accordingly, all firms anticipate and respond to the expected actions and reactions of rival producers, and, as a result, strategic or game theoretic considerations become a central feature of modeling behavior in these industries.

More importantly, as Saving (1970) and Landes and Posner (1981) have shown, in the DF/CF model there is no a priori presumption of significant market power on the part of the dominant firm. Rather, the extent of control this firm exercises over price in this model is an open question, where the answer hinges not only on market share but also on market demand and fringe supply elasticities. Thus, while both groups apparently agree that, to be classified as a dominant firm, a producer must have a relatively large market share, they disagree on whether that share necessarily implies economically significant market power. In this paper, we employ the second, less pejorative definition. We will assume that AT&T is a dominant firm in the sense of the DF/CF model and examine empirically whether it holds significant market power (i.e., whether AT&T is "dominant" under the alternative definition.)

III. Conceptual Considerations and the Empirical Model

What Bresnahan (1989) labels the "new empirical industrial organization" (or NEIO) is largely concerned with estimation of econometric models of individual industries for the

purpose of measuring the extent of market power present.¹³ Under certain conditions, natural market events may generate data that allow researchers to draw inferences about the percentage departure of price from marginal cost, even though the relevant marginal costs are generally unobservable.¹⁴ When such events occur, fairly generalized models of industry demand functions and individual firms' supply relations can yield estimates of structural parameters that shed light on the type of behavior exhibited by market participants, i.e., whether the firms are colluding or competing.

Within this class of models, an important approach has been estimation of firms' residual demand elasticities.¹⁵ Because of the functional relationship that exists between the individual firm's price elasticity of residual demand and the Lerner index of market power, estimation of a company's residual demand curve provides a direct method of calculating the degree of market power it enjoys.¹⁶ Therefore, to evaluate the extent of AT&T's market power in the post-divestiture long distance market, we estimate the price elasticity of this firm's residual demand.

Direct estimation of this elasticity, however, is precluded by two considerations. First, as explained by Baker and Bresnahan (1992, p. 7), estimation of residual demand functions

¹³ Bresnahan (1989, p. 1013) states that: "A typical NEIO paper is first and foremost an econometric model of an industry."

¹⁴ The relevant marginal costs are marginal opportunity costs, which are seldom, if ever, reflected in the available accounting cost data.

¹⁵ See Baker and Bresnahan (1992). For an application of residual demand estimation, see Baker and Bresnahan (1988).

¹⁶ Residual demand estimation has also been applied to the issue of market definition. See Scheffman and Spiller (1987).

requires identification of exogenous variables that shift one firm's marginal costs without affecting the costs of other firms in the industry. Firms competing in the long distance market, however, all purchase essentially the same set of inputs at roughly equivalent prices.¹⁷ Consequently, AT&T has not experienced the sort of cost shifts that would allow identification of its residual demand curve from the available data.¹⁸ And second, because of continued regulation of this firm's pricing decisions, it cannot be assumed that the company is located at a profit-maximizing equilibrium over the sample period.¹⁹ As a result, the first-order condition that provides the theoretical link for connecting residual demand elasticity to the Lerner index is unlikely to be satisfied here.

Therefore, both the nature of this industry's data and conceptual difficulties caused by continued regulation prevent us from direct estimation of AT&T's residual demand curve. A

¹⁷ In the period immediately following divestiture, access to the local exchange carriers' networks offered to AT&T's competitors was inferior in quality to that provided to AT&T. Under FCC and state public utility commission rules, a discount for this inferior access, generally equal to 55 percent, was applied to the "non-premium" access purchased by AT&T's competitors. This created a cost asymmetry between AT&T and its competitors. Under the "equal access" provisions of the Modification of Final Judgment, however, the BOCs now provide equal access arrangements in the overwhelming preponderance of their exchange offices. As a result, the prices paid for access by the various interexchange companies has converged rapidly over time. Given the widely available supply of the other inputs necessary to provide long distance service, no other sources of cost differences or cost shifts that uniquely affect AT&T can be identified that would permit an "off-the-shelf" estimation of the residual demand curve along the lines identified by Baker and Bresnahan (1992).

¹⁸ The absence of these necessary cost shifts and the resulting inability to estimate residual demand directly in this industry are alluded to in Taylor and Taylor (1993, p. 189). Here, these authors state that: "... we were unable to estimate individual-firm elasticities. These results may be due to poor price data and limited independent variation in those data for AT&T and its competitors ..."

¹⁹ Empirical evidence suggests that continued relatively stringent regulation of this firm has caused it to charge higher rates than it voluntarily selects under more relaxed regulation. See Mathios and Rogers (1989) and Kaestner and Kahn (1990).

less direct approach is required. Fortunately, such an approach is feasible if we can impose additional structure by adopting a specific market model that: (1) is well suited to the industry we are examining, and (2) allows the extent of AT&T's market power to be empirically determined.

Specifically, to provide the structure necessary to evaluate the degree of AT&T's market power in the interstate long distance market, we make use of the DF/CF model. The principal assumptions of this model are: (1) there is one (dominant) firm that holds a relatively large share of the market; (2) there is a fringe of much smaller firms that take the dominant firm's price as given; and (3) the product is homogeneous.

These assumptions appear to be reasonably well-satisfied in the long distance market. First, AT&T still retains a relatively large share of the market (approximately 62 percent of the minutes-of-use).²⁰ Second, there are many other competitors in this market, none of which holds an individually large market share. The largest of these firms, MCI, has only about 15 percent of the market.²¹ And third, since divestiture, the services provided by all interexchange carriers have become increasingly homogeneous, in part because of the widespread availability of equal access to local exchange company facilities and the

²⁰ See Federal Communications Commission (1994). AT&T's capacity (or asset)-based market share is considerably lower than this. Haring and Levitz (1989) estimate that AT&T has only about 40 percent of the capital assets in this market.

²¹ It is important to note here that our characterization of MCI, Sprint, LDDS, and other competitors in the long-distance marketplace as "fringe" firms is adopted here as a modelling convention, and is not meant to imply that they are individually small (e.g. both MCI and Sprint appear on the Fortune 500 list of the largest corporations of America) or that collectively they do not have the clout to discipline the pricing behavior of AT&T. Indeed, the disciplinary effects of these fringe firms is an empirical question and is the principal issue addressed below in our econometric estimation.

widespread adoption of fiber optic transmission facilities. Such increased homogeneity is evidenced in the marked convergence of the prices charged by the various competitors since divestiture.²² Given this close correspondence between the assumptions of the DF/CF model and the structural attributes of the industry, utilization of this model to evaluate AT&T's market power seems to be a sound approach.²³

Given the DF/CF model, the residual demand curve faced by AT&T is given by the total market demand curve minus the collective supply curve of the competitive fringe, i.e.

$$Q_{ATT}(P) = Q_M(P) - Q_F(P), \quad (1)$$

where P is the price of long distance service, $Q_{ATT}(P)$ is AT&T's residual demand, $Q_M(P)$ is market demand, and $Q_F(P)$ is fringe supply. Due to the price-taking behavior exhibited by fringe producers, $Q_F(P)$ is given by the collective marginal cost curve of these firms. As shown by Saving (1970), equation (1) may be manipulated to obtain the dominant firm's residual demand elasticity as a function of three underlying structural parameters:

where η_{ATT} is AT&T's residual demand elasticity, η_M is the market demand

²² Evidence of such convergence is provided in Kaserman and Mayo (1994).

²³ Indeed, the framework adopted here increasingly appears to constitute the theoretical underpinnings for the development of federal regulatory policy. For instance, in the recent FCC order eliminating price regulation of the commercial long-distance services of AT&T, the Commission relied upon virtually all of the DF/CF criteria. See *Report and Order* (CC Docket No. 93-197), Released January 12, 1995. Our approach, then, is perfectly congruent with the evolving federal regulatory policy. Whereas the Commission has to date relied upon qualitative indicators, we are able to provide quantitative measurement of the degree of market power.

$$\eta_{ATT} = \frac{\eta_M}{S_{ATT}} + \frac{(1-S_{ATT})\epsilon_F}{S_{ATT}}, \quad (2)$$

elasticity, S_{ATT} is AT&T's market share, and ϵ_F is the price elasticity of fringe supply.

Equation (2) may be used to calculate η_{ATT} from prior estimates of three underlying structural parameters -- η_M , ϵ_F , and S_{ATT} . Estimates of S_{ATT} and η_M are readily available in the published literature. No such estimates of ϵ_F , however, exist. In fact, one could argue that the absence of such an estimate is the principal source of the ongoing debate regarding the intensity of competition (and, therefore, optimal regulatory policy) in this market. Therefore, in order to implement equation (2), we must first estimate the price elasticity of fringe supply.

Toward this end, we specify a simple simultaneous model of competitive fringe supply and market demand in the interstate long distance market. The theory of supply suggests the following general specification for the inverse supply curve of the fringe:

$$P = P_F(Q_F, PA, EA). \quad (3)$$

Here, Q_F is the fringe output, PA is the price long distance firms pay to the local exchange companies on a minutes-of-use basis for access to the local network, and EA is the percent of telephone lines converted to equal access. Carrier access is the predominant input required for the production of long distance service, generally accounting for over half of these firms' total costs (and even more of their marginal costs). Thus, $\partial P_F / \partial PA > 0$ is expected to hold. Holding the price of access constant, conversion of local exchange company facilities to equal

access tends to reduce the costs of fringe producers providing long distance service. Hence, we expect $\partial P_F / \partial EA < 0$.

Finally, because fringe supply is expected either to slope upward or to be horizontal, $\partial P_F / \partial Q_F \geq 0$ should hold. It is this last parameter, of course, that is the primary focus of our attention, because it reveals the ability and willingness of AT&T's competitors to enter and expand in response to any attempted price increases. That ability, in turn, is a primary determinant of AT&T's market power. The closer this parameter is to zero (i.e., the more elastic is fringe supply), the lower are barriers to entry and expansion and, therefore, the greater the intensity of potential competition. Conversely, a large positive coefficient on Q_F would indicate a relatively inelastic fringe supply with comparatively ineffective potential competition.

Turning to the inverse market demand function for long distance service, we specify:

$$P = P_M(Q_M, P_L, PHONE, PHONESQ, Y, D_i), \quad (4)$$

where Q_M is the market quantity, P_L is a n index of real prices for local telephone service, $PHONE$ is the number of U.S. households that subscribe to telephone service, $PHONESQ$ is the square of $PHONE$, Y is real per capita income, and D_i is a vector of three quarterly dummies. We expect market demand to slope downward. We expect increases in the price of local telephone service to reduce the demand for long distance service due to the complementary nature of these products.²⁴ We expect increases in household subscribership

²⁴ Hausman, Tardiff, and Belinfante (1993) report empirical evidence of such complementarity.

generally to increase market demand. We allow for a nonlinear (quadratic) relationship between subscribership and demand due to the network characteristic of telecommunications consumption—a doubling of subscribers is likely to more than double the market demand. Finally, we expect increases in income to increase long distance demand. Thus, our hypotheses regarding equation (4) are that $\partial P_M / \partial Q_M < 0$, $\partial P_M / \partial P_L < 0$, $\partial P_M / \partial \text{PHONE} > 0$, and $\partial P_M / \partial Y > 0$. No hypotheses are expressed with respect to D_i . Our primary interest will be in the parameter associated with Q_M due to its relationship to the market price elasticity of demand and the corresponding relationship of that elasticity to the Lerner index.

Equations (3) and (4) constitute a simultaneous DF/CF model with P , Q_M , and Q_F endogenous. The exogenous variables included in this system are PA , EA , P_L , PHONE , PHONESQ , Y , and D_i . Estimation of these two structural relationships provides estimates of η_M and ε_F that, together with observed values of S_{ATT} , can be used to calculate η_{ATT} via equation (2). This elasticity of residual demand, in turn, can be used to calculate the Lerner index for AT&T in the post-divestiture period.

IV. Data and Estimation Results

The data used for estimation of equations (3) and (4) are quarterly observations covering the time period from 1984:3 through 1993:4. Thus, our sample contains 38 observations. Table 1 provides our variable definitions and data sources.

TABLE 1

Variable Names and Definitions

Variable Name	Definition	Sources
Q_M	Interstate switched access minutes of all long distance carriers	(2)
P_L	Real consumer price index for local telephone service (1982 - 1984 = 100) ¹	(1)
PHONE	Number of households with telephone service, measured in millions	(2)
PHONESQ	PHONE * PHONE	
Q_F	Interstate switched access minutes by carriers other than AT&T	(2)
P_A	Real price of total access charges per conversation minute ²	(1)
P	Average daytime real price of AT&T's long distance interstate telephone service for a 10 minute 200 mile call ³	(1)
EA	Percentage of total industry lines converted to equal access	(2)
Y	Real disposable per capita income ⁴	(3)
D_i	Quarterly dummies, $i = 2, 3, 4$	

- SOURCES: (1) Reference Book: Rates, Indexes, and Household Expenditure for Telephone services, Industry Analysis Division, Common Carrier Bureau FCC, May 1993.
- (2) Statistics of Communications Common Carriers, FCC 1991/1992 edition.
- (3) Economic Report of the President, 1985-1994 editions, United States Government Printing Office, Washington.

¹ P_L is calculated by deflating the nominal consumer price index for local telephone service with the consumer price index for all goods and services.

² P_A includes originating carrier common line charges, terminating carrier common line charges, and traffic sensitive charges. Note also that P_A is calculated by deflating nominal access charges with the implicit price deflator.

³ Real prices are calculated by deflating nominal prices with the implicit price deflator.

⁴ Real per capita income is calculated by dividing nominal per capita income with the implicit price deflator (1982 = 1).

TABLE 2

Inverse Fringe Supply Equation
2SLS Estimates

Variables	Coefficient	t-Statistic
Intercept	0.059	1.921**
Q_F	0.002	3.346*
P_A	1.860	11.293*
EA	-0.001	-6.173*

 $R^2 = .99$

F = 2133.269

Durbin-Watson = 1.945

*Significant at the .01 level.

**Significant at the .10 level.

TABLE 3

Inverse Market Demand Equation
2SLS Estimates

Variables	Coefficient	t-Statistic
Intercept	9.313	5.747*
Q_M	-0.006	-4.655*
P_L	-0.003	-5.063*
PHONE	-0.206	-5.642*
PHONESQ	0.001	6.630*
Y	1.07×10^{-5}	5.104*
D_2	0.002	0.625
D_3	0.009	2.152**
D_4	0.009	2.107*

 $R^2 = .99$

F = 737.043

Durbin-Watson = 1.808

*Significant at the .01 level.

**Significant at the .05 level.

Results obtained from estimating the fringe supply curve in linear form with two-stage least squares (2SLS) are reported in Table 2.²⁵ These results are very encouraging. The explanatory power of the model is quite high, and all coefficients attain the expected signs. Moreover, all parameters are statistically significant. The positive sign on the coefficient of Q_F indicates an upward-sloping fringe supply. The positive sign on the coefficient of PA suggests that fringe supply shifts backward with increases in access charges. The negative sign attached to the coefficient of EA confirms our expectation that the provision of equal access increases fringe supply.

Most important, the 2SLS results produce a fringe supply elasticity estimate of 4.38 at the sample means. Thus, our results suggest a large supply response to a price change on the part of fringe firms in this industry. This finding, in turn, is consistent with prior arguments that have posited an absence of significant barriers to entry and expansion in this industry.²⁶

Next, Table 3 reports our estimation results for the interstate long distance telecommunications market demand function using 2SLS.²⁷ Here, too, the results appear to be quite reasonable. The model exhibits considerable explanatory power, and all hypothesized coefficient signs are obtained. Moreover, all coefficients except the second-quarter dummy are significant at the .05 level or higher. These results confirm a downward-

²⁵ The model was also estimated with three-stage least squares (3SLS). Because the 3SLS results are virtually identical to the 2SLS results, we report only the latter here.

²⁶ Katz and Willig (1983), Porter (1993), and Kaserman and Mayo (1988) have made such arguments.

²⁷ This equation is also estimated here in linear form. A double-log specification was estimated as well, but the results are essentially the same as those reported here. Additionally, the equations were estimated using three-stage least squares, with no substantive changes from the results reported here.

sloping market demand that declines with higher local telephone rates. The coefficients attached to PHONE and PHONESQ suggest a U-shaped relationship between subscribership and long distance demand. At the sample mean, however, $\partial P / \partial \text{PHONE} = 0.0093 > 0$, and $\partial^2 P / \partial \text{PHONE}^2 = 0.002 > 0$. Thus, at these values, demand increases at an increasing rate as subscribership rises. This result is consistent with theoretical expectations for products subject to network effects. Finally, long distance demand increases with per capita income (it is a normal good) and is significantly higher in the third and fourth quarters.

For our purposes, the result that is of primary importance is the market price elasticity of demand. At the sample mean, the results reported in Table 3 yield an elasticity estimate of -0.49. Given the time series nature of our data, this estimate should correspond to a short-run demand elasticity. Accordingly, this figure conforms with, but is at the low end of the range of elasticities for this market reported in Lester Taylor's (1994) recent survey.²⁸

V. Residual Demand Elasticity and Market Power Calculations

Given the above estimates of ϵ_F and η_M and knowledge of AT&T's market share, S_{ATT} , we can calculate estimates of AT&T's residual demand elasticity and corresponding estimates of the Lerner index for this firm. Market share figures are generally based upon either output or capacity.²⁹ FCC figures indicate an output-based market share for AT&T

²⁸ Taylor (1993, p 17) states that: " In general, these new studies show price elasticities of -0.5 to -0.75 for interLATA (i.e., longer-haul) toll calling...". Also, see Gatto, *et al.* (1988).

²⁹ See, e.g., the Department of Justice and Federal Trade Commission 1992 Horizontal Merger Guidelines, which, depending on the particular circumstances prevalent in a market, state that these agencies will use either total sales or capacity to calculate market shares. Hovenkamp

of approximately 62 percent, while Haring and Levitz (1989) report that AT&T's share of industry assets is equal to 40 percent.

Thus, given these two alternative values of S_{ATT} , we can substitute the estimated values of ε_F and η_M into eq. (2). These substitutions yield values of AT&T's residual demand elasticity of -3.48 and -7.81, for the output-based and capacity-based market shares, respectively. The corresponding values of the Lerner index, then are 0.29 and 0.13. Given that the theoretical range of the Lerner index is from zero to unity, the relatively low values of these estimates suggest that AT&T has no significant market power in the pricing of long distance services.³⁰

These figures, however, are somewhat difficult to interpret in isolation. To gain a better perspective on what these numbers imply, it is useful to compare them with similar estimates for other industries. Two recent studies provide a basis for such comparison. First, a paper by Hall (1988) reports estimates of the ratio of marginal cost to price for 26 U.S. industries. He labels this ratio β . Given the definition of the Lerner index, λ , and the definition of β , Hall's estimates can easily be transformed into estimates of the Lerner index for these industries. Specifically, $\lambda = (P - MC)/P = 1 - \beta$. Table 4 reports the results of this simple transformation of Hall's estimates along with the corresponding estimates of the implied residual demand elasticities.

(1987, pp. 7-8) argues that a capacity-based share is more meaningful in the long distance telecommunications market.

³⁰ Interestingly, Ward (1993) uses an alternative econometric model and different data to quantify the magnitude of AT&T's own-price elasticity and its associated Lerner index with very similar results to those reported here.

TABLE 4
Hall's Market Power Estimates for Other (Unregulated) Industries

INDUSTRY	β (MC/P)	λ (P-MC)/P = 1- β	η P/(P-MC) = 1/ λ
FOOD AND KINDRED PRODUCTS	0.189	0.811	1.23
TOBACCO MANUFACTURES	0.362	0.638	1.57
TEXTILE MILL PRODUCTS	0.388	0.612	1.63
APPAREL AND OTHER TEXTILE PRODUCTS	1.213	-0.123	-4.69
LUMBER AND WOOD PRODUCTS	0.555	0.445	2.25
FURNITURE AND FIXTURES	0.506	0.494	2.02
PAPER AND ALLIED PRODUCTS	0.269	0.731	1.37
PRINTING AND PUBLISHING	0.07	0.93	1.08
CHEMICALS AND ALLIED PRODUCTS	0.05	0.95	1.05
PETROLEUM AND COAL PRODUCTS	-0.007	1.007	0.99
RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS	0.663	0.337	2.97
LEATHER AND LEATHER PRODUCTS	0.476	0.524	1.91
STONE, CLAY, AND GLASS PRODUCTS	0.394	0.606	1.65
PRIMARY METAL INDUSTRIES	0.46	0.54	1.85
FABRICATED METAL PRODUCTS	0.607	0.393	2.54
MACHINERY, EXCEPT ELECTRICAL	0.7	0.3	3.33
ELECTRICAL AND ELECTRONIC EQUIPMENT	0.324	0.676	1.48
INSTRUMENTS AND RELATED PRODUCTS	0.716	0.284	3.52
MISCELLANEOUS MANUFACTURING INDUSTRIES	0.223	0.777	1.29
COMMUNICATION	0.028	0.972	1.02
ELECTRIC, GAS, AND SANITARY SERVICES	0.079	0.921	1.09
MOTOR VEHICLES AND EQUIPMENT	0.567	0.433	2.31
OTHER TRANSPORTATION EQUIPMENT	1.053	-0.053	-18.87
TRANSPORTATION	0.251	0.749	1.34
WHOLESALE TRADE	-0.271	1.271	0.79
RETAIL TRADE	0.425	0.575	1.74

Source: Hall (1988) and authors' calculations.

Comparing these estimates to our estimates for AT&T, we find that, relative to industries such as Paper and Allied Products, Chemicals and Allied Products, and Electrical and Electronic Products (none of which are price regulated), AT&T possesses remarkably little market power. The mean value of our Lerner index estimates for AT&T is 0.207, while the mean of the 22 industries for which Hall's estimates fall within the theoretically acceptable range (i.e., for which $0 \leq \lambda < 1$) is 0.62. Thus, on average, our estimates suggest that AT&T holds substantially less market power than exists in these other industries. Moreover, the maximum estimate of λ we obtain for AT&T is 0.29. This value is below every single industry in Hall's sample except one (Instruments Related Products) that generated a Lerner index value within the acceptable range. Thus, relative to these other industries (all of which are unregulated), AT&T appears to face very effective competition.

Finally, Bresnahan's (1989) survey of prior empirical studies of market power in individual industries (examples of the NEIO) presents a table summarizing the Lerner indices estimated by various authors (Table 17.1, p. 1051). That table is reproduced here as Table 5. Almost a dozen industries are represented. The range of estimated market power is quite broad, with the Lerner index ranging from a low of 0.025 to a high of 0.88. Nonetheless, our estimates of AT&T's Lerner index clearly fall toward the low end of the reported indices. The mean Lerner index in Table 5 is 0.296, which is slightly above even our maximum estimate for AT&T.

Thus, this comparison also supports the conclusion that, relative to other firms in the U.S. economy, AT&T possesses very little market power. While it may be a dominant firm in the theoretical sense envisioned in the DF/CF market model, it is not dominant in the sense